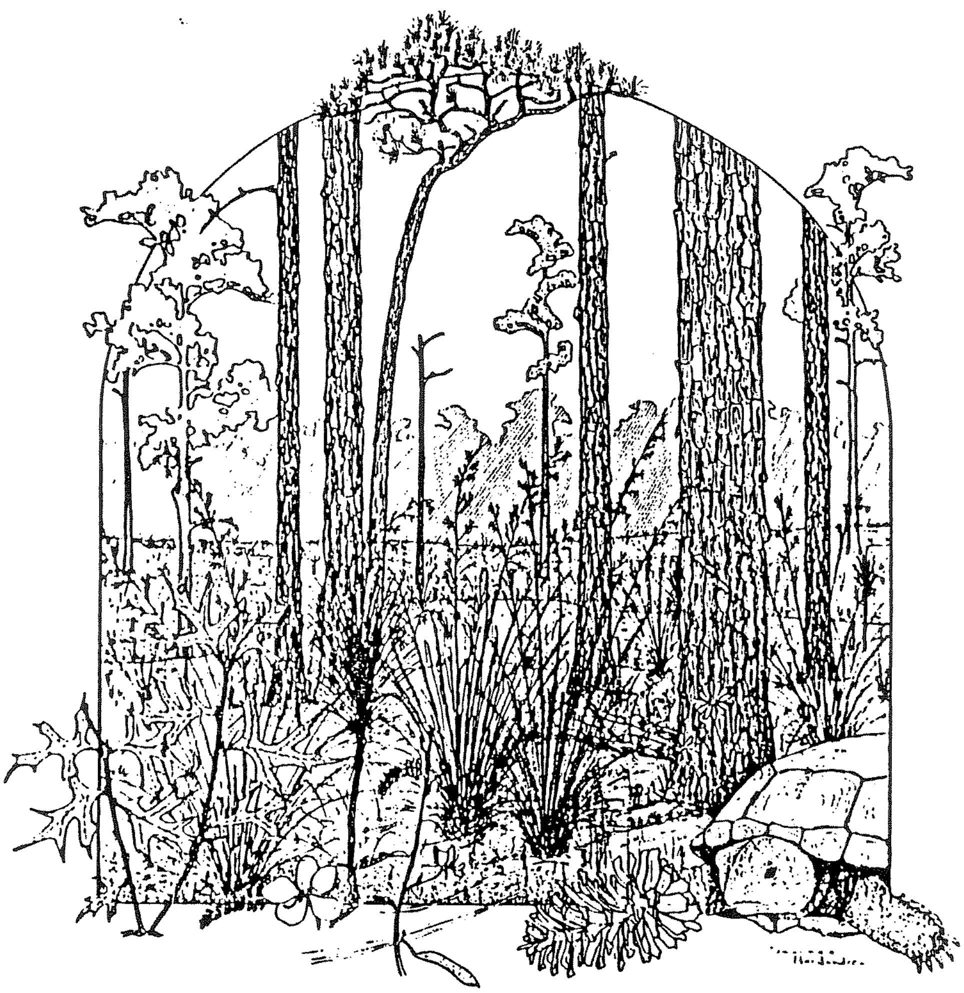
WIREGRASS BIOLOGY AND MANAGEMENT

MAINTAINING GROUNDCOVER INTEGRITY IN LONGLEAF PINE ECOSYSTEMS



Proceedings of the Symposium
October 13, 1988
Valdosta State College
Valdosta, Georgia

KBN Engineering and Applied Sciences, Inc.
1034 Northwest 57th Street, Gainesville, Florida 32605

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Maintaining Groundcover Integrity in Longleaf Pine Ecosystems

Edited by Linda Conway Duever and Reed F. Noss

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Response of Wiregrass (Aristida stricta) to Mechanical Site Preparation

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Abstract. Because of beneficial attributes, it is often desirable to maintain wiregrass (*Aristida stricta*), also known as pineland threeawn, in the understory of communities in the Southeastern coastal plains. Results of site preparation studies on several north Florida sites were compared to evaluate the degree of wiregrass damage resulting from different treatment methods. Conclusions indicate that to minimize the impact of mechanical site preparation on wiregrass only single-pass treatments should be used on sandhills sites, with a single-drum chopper the best choice. Single-pass treatments are also recommended for flatwoods sites when trying to avoid a sustained decline in wiregrass. Information on the effect of application season, prior burning, and soil moisture level is needed to refine prescriptions.

Introduction

Wiregrass (*Aristida stricta* Michx.) is a major understory species in the slash pine (*Pinus elliottii* Engelm.), south Florida slash pine (*P. elliottii* var. *densa* Little and Dorman), longleaf pine (*P. palustris* Mill.), longleaf-slash pine, and longleaf-scrub oak forest types of the Atlantic and Gulf coastal plains (Eyre 1980). These communities cover approximately 10 million hectares from North Carolina to Florida (Southern Section SRM 1974) and represent a major resource base for production of wildlife, timber, water, cattle, and recreation. Fire is a frequent natural occurrence across much of the area, helping to maintain the communities (Christensen 1981). Wiregrass is most prevalent on deep, infertile sands ranging from poorly-drained flatwoods soils, typified by the Leon series (sandy, siliceous, thermic, Aeric Haplaquod) to excessively-drained sandhill soils like Lakeland (thermic, coated Typic Quartzipsamment).

Because of its low nutrient content and poor digestibility, wiregrass produces low-quality forage for livestock and wildlife (Lewis et al. 1975). Its ability to develop a dense root mat just below the soil surface makes it a strong competitor during pine regeneration (Haines et al. 1975). This competition can be especially severe on dry sites where wiregrass can significantly reduce pine seedling survival (Scheer and Woods 1959). Because of these traits, wiregrass was viewed for many years as an undesirable species by land managers producing forage, wildlife, or timber (Moore 1974). More recently, however, land managers have realized that wiregrass is an important fuel source for prescribed fires (Christensen 1981) which are used to reduce the risk of damaging wildfires and are needed to prevent invasion of pine-wiregrass areas by hardwood species (Komarek 1977). In longleaf pine stands these wiregrass-fueled fires also control brown-spot needle blight (*Scirrhia acicola* (Dearn.) Siggers), which can severely limit growth and survival of pine seedlings (Boyer 1975). In addition, an understory of wiregrass maintains a more favorable soil environment by improving soil structure along with water and nutrient holding capacity (Snedaker and Lugo 1972).

Numerous mechanical systems have been used for reducing the amount of wiregrass competition when pine stands are being regenerated. Single treatments with a drum chopper disturb but do not seriously affect wiregrass (Grelen 1959, Sheer and Woods 1959). Double chopping, however, can nearly eliminate the wiregrass component on dry sandhill sites (Grelen 1962) and can greatly reduce it on flatwoods sites (Moore 1974). It is similarly reduced on flatwoods sites by other dual mechanical site preparation treatments such as disking and double bedding (Schultz and Wilhite 1974). Since it is now thought that wiregrass is often beneficial after the initial seedling establishment phase, site preparation techniques which only temporarily reduce wiregrass seem appropriate. The studies cited above cover short-term responses of mostly 1 to 2 years with a few as long as 5 years. Reported here are the results of three studies designed to assess the effect of different mechanical site preparation methods on long-term changes in wiregrass cover.

Methods

The dry study sites are located on three sandhills areas in Calhoun County in northwest Florida and will be referred to as the sandhill study. Treatments were, (1) none (control); (2) prescribed burning; (3) burning and single chopping; (4) burning and BSW bulldozing; (5) burning and rootraking; (6) burning and double chopping; (7) burning and double BSW blading, and; (8) burning, rootraking, and disking. The chopper used was an 11-ton model with two large water-filled metal rollers which had metal blades attached diagonally across their surface. The rollers were offset at 22° angles, one forward and one reverse, which caused them to slice and move soil as they turned. The BSW blade was v-shaped with a lower knife edge and an upper pipe attachment. The pipe bent over the trees which were then sheared off at the ground line by the lower cutting edge of the blade. Rootraking was done with a straight blade with 30 cm long tines attached to the lower edge. These tines were pushed through the soil tearing out the root systems while the blade above knocked over the trees. Using a randomized block design, eight 0.4-ha plots were established at each of three locations in January 1955 in former longleaf pine stands. Prior to treatment, these sites were dominated by scrub oak-wiregrass vegetation. Burning was done in May 1955 followed by the first mechanical treatments in June and the final treatments on the double treatment plots in September, except for the second BSW treatment, which was done in January 1956. Slash pine seedlings were planted in January 1956 at 1.8 x 2.75 m spacing.

A second study is located on the Olustee Experimental Forest in Baker County, northeast Florida (Olustee study). This was a typical flatwoods site with a 60-year-old longleaf pine stand on a Leon soil (Schultz 1976). The area was clearcut in 1968 and site preparations applied to 0.25 ha plots in 1970. Treatments were: control; burn; burn and double disk; burn, double disk, and bed. Double disking means making two passes over the entire area with a heavy, dual-section wood disk. Treatments were applied in a randomized block design with three replications. Slash pine seedlings were hand planted in February 1971 at a 2.2 x 3 m spacing.

A third study is also located in Baker county on two typical flatwoods areas (disking study). Treatments were control, one disking, two diskings, and three diskings. These treatments were applied at random to plots 90 x 90 m at two locations. Slash pine seedlings were planted on the plots at 2.4 x 3 m spacing.

Wiregrass cover was assessed during autumn on all studies along 30-m line transects by the line-intercept method. The total number of the 15-cm segments of the line transect that contained wiregrass was used to calculate percent cover. Transects were installed from random starting points perpendicular to rows of planted trees. Analysis of variance after arc sine transformations was used to assess differences in the sandhills and Olustee studies. Analysis of covariance, using pretreatment cover as the covariate, was used in a time series analysis to determine differences in the disking study.

Results

Initially, wiregrass cover on the sandhills study was estimated to be 20 to 30 percent. After 33 years, wiregrass cover on control plots had not changed substantially (Table 1). Plots which had been burned only had significantly more wiregrass cover than any other treatment, including the control. The rootraking site-preparation treatment appeared to reduce wiregrass cover, but the difference was not significant compared to the control. Both of the other single pass treatments caused a significant long-term reduction of wiregrass. The double chopping and the rootraking and disking treatments eliminated wiregrass from the site, and after 33 years it has not reinvaded. There was no difference in wiregrass cover between the single and the double BSW treatments.

All of the treatment plots in the Olustee study had an equal amount of wiregrass cover prior to site preparation (Table 2). Two years later plots receiving mechanical treatments had significantly less wiregrass cover than controls or burn-only plots. These differences have remained after 18 years.

In the disking study, all levels of treatment caused an initial reduction in wiregrass (Table 3). After 5 years however, wiregrass had recovered on the 1 and 2 disking treatments to pretreatment cover values, but remained at reduced levels on the plots given three diskings.

From 5 to 20 years there was no pronounced change in wiregrass cover for any treatment. The mean cover values for this period were 17, 10, 10 and 3 percent for control, one, two, and three disking treatments, respectively. Only the three disking treatment had notably less wiregrass cover compared to the pretreatment values.

Discussion

Wiregrass cover is reduced by mechanical operations in two ways: by a reduction in aboveground biomass by individual grass bunches (damage) and by a reduction in the number of bunches (death). Both of these changes appear to result largely from root desiccation from exposure by cultivation. Because wiregrass can exist for long periods of time with very low production under a dense overstory, and can then respond when resources become available, the reduction in aboveground production by wiregrass bunches should be temporary. This temporary reduction followed by increased production because of additional resources is apparent in the Table 3 data for the one and two disking treatments. The loss of wiregrass bunches is a much more permanent change because wiregrass reproduces almost exclusively by vegetative means (Parrott 1967). A reduction in the number of wiregrass bunches is likely why wiregrass did not return to its former level on many of the treatments.

Site preparation is only one of the many management operations that a site receives which may affect wiregrass cover. Other important factors include tree planting density, herbicides, grazing, and fire. A higher tree density on the Olustee site compared to the disking study site, 1440 vs. 860 trees/ha, could have contributed to the apparent difference in wiregrass response to two passes with a disk. Alternatively, this could be due to site differences or effective impact of the disking because of application at different seasons or under different conditions. The latter is more likely because the disking study site had a lower density of wiregrass bunches on double-disked treatment plots than on the control plots 2 years after treatment (Schultz 1976) showing a loss of wiregrass clones from the treatment.

It is apparent from the data that mechanical site preparation can cause a significant and long-lasting reduction in wiregrass cover, but this does not necessarily have to occur. What is desired is a properly prescribed and applied mechanical site preparation system which will reduce wiregrass cover due to a reduction in aboveground biomass, but will not affect the density of wiregrass bunches, thus allowing wiregrass cover to rapidly return to preharvest levels with appropriate management.

Although rootraking did not significantly reduce wiregrass on the dry sandhill sites, we do not recommend it because of excessive soil movement. Although the other single-pass treatments did cause a long-term decline in wiregrass, the sites still had greater than 10 percent wiregrass cover. Since wiregrass carbohydrate reserves are lowest in midsummer (Woods et al. 1959) when the treatments in these studies were applied, application during other seasons may have less impact on wiregrass. Rainfall most likely also affects the impact of mechanical operations on wiregrass. June 1955 was much drier than normal, with only 20 mm of precipitation compared to the normal of 135 mm, and precipitation in September was only half the normal amount. These abnormally dry conditions likely increased the loss of wiregrass. The lack of additional impact from the second BSW operation which was applied in January 1956 was likely due to a combination of higher root reserves and above normal rainfall. Even after 33 years the beneficial effect of fire is evident on burn only plots. Using fire to stimulate and increase the vigor of wiregrass a couple of years prior to site preparation might reduce the impact of that operation. Further investigation is warranted to develop and fine tune an appropriate site preparation system for sandhill sites. Based on present knowledge a single chop treatment seems most appropriate for preparing these dry sandhill sites, but a single-drum chopper should be used instead of the double-drum model used in the study because it has been shown to cause little serious effect to wiregrass (Sheer and Woods 1959). Potential damage to wiregrass could be reduced even further without a reduction in growth of some tree species by using strip site preparation methods (Outcalt 1988).

In the flatwoods, single-disk treatments should not permanently affect the wiregrass cover. Thus, there will be only a short-term reduction in wiregrass cover with this treatment. The predominant treatment used today for flatwoods sites is bedding. Unfortunately, bedding alone was not included in any of the flatwoods studies, but they did show a severe reduction in wiregrass when double disking and bedding were used together. Bedding alone should have less of an impact, but how it compares to untreated or single disk sites is not known.

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Table 1. Mean (n = 3) wiregrass cover on a sandhills site in northwest Florida 33 years after site preparation by different methods.

Treatment	Pretreatment	Wiregrass cover after 33 years
		-percent-
Control	20-30%[1]	34a[2]
Burn	20-30%	68b
Burn and single chop	20-30%	11c
Burn and BSW blade	20-30%	14c
Burn and rootrake	20-30%	22ac
Burn and double chop	20-30%	1d
Burn and double BSW blade	20-30%	16c
Burn and rootrake and disk	20-30%	0d

1 Estimated coverage.

2 Means within a column not followed by the same letter are significantly different at the .05 level.

Table 2. Mean (n = 3) wiregrass cover at the Olustee, Florida, flatwoods site after site preparation by different methods.

Treatment	Cover		
	Pretreatment	2 years	18 years
		-percent-	
Control	12.8a[1]	12.5a	16.7a
Burn	11.2a	13.6a	12.7a
Burn & double disk	11.0a	5.0 b	3.3 b
Burn, double disk, & bed	11.6a	2.4 b	0.8 b

1 Means within a column not followed by the same letter are significantly different at the .05 level.

Table 3. Mean (n = 2) wiregrass cover after different intensities of disking on the Baker County, Florida, flatwoods site.

Treatment	Wiregrass cover				
	Pretreatment	1-yr	5-yr	10-yr	20-yr
			-percent-		
Control	13.0	15.4	17.0	15.5	16.2
1 Disking	15.7	5.8	11.8	12.0	7.5
2 Diskings	7.8	2.5	7.2	4.0	12.5
3 Diskings	24.2	5.0	4.8	8.5	5.3